Memorandum

To: Elizabeth McKenna and Monica Tonel, US Environmental Protection Agency

From: Whitney Fraser, Environment International Ltd.

Re: Field sampling conducted by Teck Cominco 2009-2010

In 2009 and 2010, consultants working on behalf of Teck Cominco performed seven field sampling trips for which the CCT have documentation. These trips are described below. Some samples had GPS locations associated with them in laboratory results tables. These locations, as well as locations that can be approximately inferred by sample name or proximity to known samples, are given in Attachment A, sorted by date of sampling. Field reports for the trips are provided in Attachments B, C, D, and E to this memo. Attachment F is a spreadsheet with information about all documented samples from the April-May trips. No cultural, historical, or archaeological oversight is documented for any of the trips.

Table of Contents

Sediment sampling in the Upper Columbia River, Lake Roosevelt, and Upland Areas in the US

April 28 – May 7, 2010

A field report for this trip is provided on pages 9-12 of Attachment B to this memo.

Personnel

"Greg Diefenbach and Mike Brewer, consulting Geologists, were contracted to run the program, including site selection, sampling and sample handling, and chain of custody documentation. Shawn Kinz and Steve Saugen, co-owners of Gravity Environmental were hired to perform the coring on their company boat, *RS Palouse*. Gravity also provided a reconnaissance boat, *El Pescador*, and operator Mark Weber for river exploration prior to coring operations."

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2861 S Race St
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303-551-4803

Mike Brewer
Unable to find contact information; likely based in Colorado.

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Locations

"Samples were collected within the Upper Columbia River watershed in Washington State, between river mile 743 and river mile 657. Vibracore samples targeted sedimentation areas including river bends and sediment bars from Northport to Inchelium. Tributary samples included Deep Creek, Big Sheep Creek, Onion Creek, Kettle River, Colville River, Hunter Creek, and Alder Creek. Hand sampled beaches and sediment bars included Black Sand Beach, the Northport waterfront and Northport/Le Roi smelter slag discharge area, Dalles Orchard Beach, China Bend bar and boat launch, North Gorge campground and boat launch, Gregor millsite at Bossburg, Evans campground and boat launch, and several unnamed sediment exposures. Tributary tailings sources included the Iroquois, Anderson-Calhoun, and Black Stone mines on Deep Creek, and the Van Stone mine on Onion Creek."

Upper Columbia River Sampling Sites - Washington

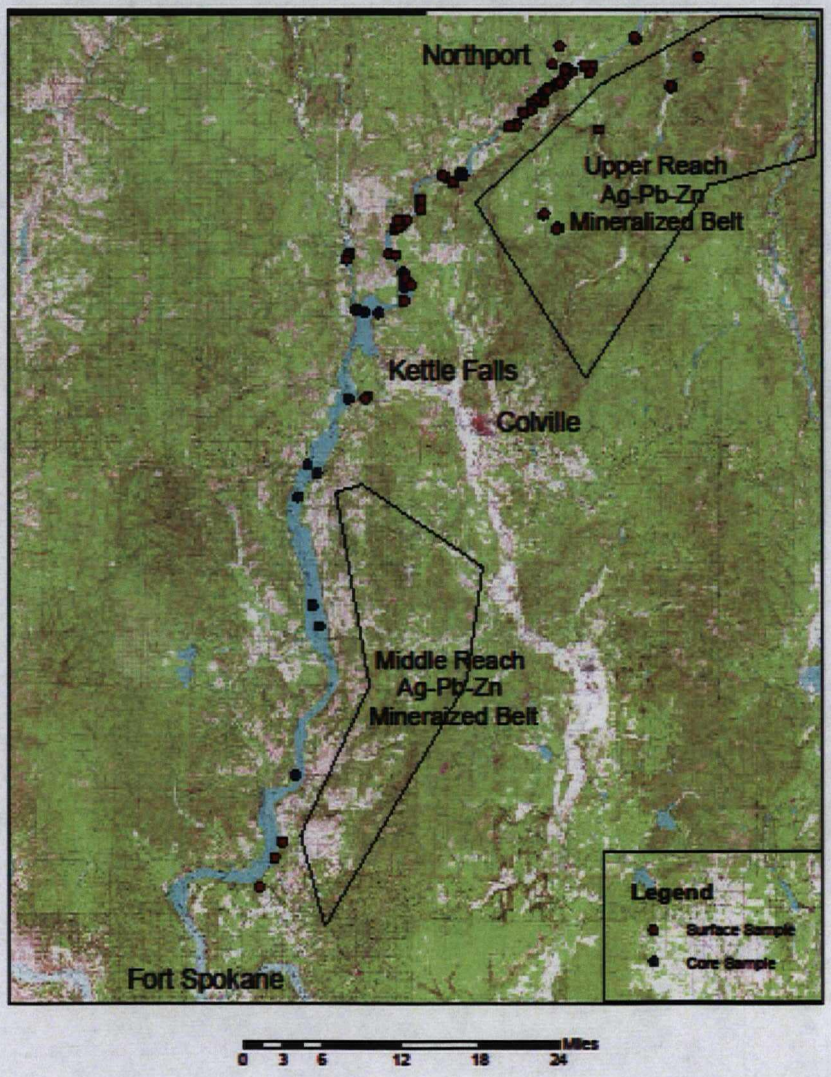

Figure 1: Map from Diefenbach Field Report

Methods

"Field activities from April 28th to May 7th, 2010 included hand sampling of surface sediments from beaches, exposed river bars, tributary over bank deposits, and tailings impoundment facilities, hand coring of shallow river bars, and Vibra-Coring of submerged sediment bars."

"Hand samples were collected at various depositional locations with the goal of representing the whole of the non-submerged area. Fine grained sediments were selected over coarse fractions to facilitate XRF analysis. Samples were collected at the surface and at depths up to 18 inches, field analyzed by XRF, and recorded by a site specific number with depth of sample, a brief description of grain size and color, and notes on any unusual characteristics. Sample sites were located by GPS for GIS mapping."

"Hand cores were collected during boat and ground reconnaissance as well as Vibra-Coring operations. Gravity supplied a hammer-jack hand coring device which pushes 1 meter length, 2 inch outside diameter Lexan tubes with sediment catchers into soft sediments. Hand cores were collected at or below waterline at several locations not conducive to Vibra-Coring or hand sampling. Hand cores ranged from 6 to 30 inches in depth and were sampled in segments of 6 to 12 inches."

"Vibracore samples were collected in water depths of 3 to 95 feet using 60 inch length, 4 inch outside diameter Lexan tubes with sediment catchers, recovering 10 to 150 cm of sediment. Coring sites were chosen on the likelihood of hitting recoverable soft sediments in areas of interest. Cores were driven to refusal at bedrock or cobble, extruded into a vinyl trough, sampled at 10 cm intervals, field analyzed by XRF, labeled and bagged. Sections of recovered native coarse gravel were discarded."

April 28 – 30, 2010

A field report for this trip written by Adrian Brown is provided in Attachment C-1 to this memo. Photos taken by Mr. Brown are in Attachment C-2. The field notebook is found on pages 46 – 57 of the Attachment.

Personnel

People accompanying this trip on April 28, according to the field notes, included Bob Weaver, Mark Ellis [sic], Sandy Reese [sic], Mark Johns of Exponent, and Greg Davis of Brown and Caldwell.

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Mark Elliott ["Mark Ellis" from the notes]
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Arthur "Sandy" Riese [misspelled in field report]
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Greg Davis
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1697 Cole Blvd., Suite 200
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303-239-5400

Locations

"April 28, 2010. Spokane, Mills, Colville, Republic, Kettle River, Canadian smelters, Trail.
April 29, 2010. Waneta Dam, ReMac, 7-Mile Dam, Pend Oreille Mine, Grandview, Sierra Zinc, Deep Creek, Anderson-Calhoun, Black Sand Beach.
April 30, 2010. Kettle Falls, Bonanza Mine, Northport smelter, Van Stone Mine, Bonanza Mill."

The following is a list of locations from Mr. Brown's field notes of the places that samples were taken. Red text denotes a sample from an area potentially requiring a CCT permit.

4/28/10

1. Hand sample taken @ sediment on bank, at Spokane River/Columbia River confluence
2. Sample of sand from bank ~30' below top water level, at Gifford Ferry
3. Colville River confluence
4. Sampled, at creek running out of Knob Hill – Granite Creek tributary
5. Rare granular slag @ pile, at Greenwood Smelter/Anaconda
6. Sampled @ roadside pile, at Grand Forks/Granby

4/29/2010

7. Apparent tails @ confluence sample taken, at Salmo River
8. Sample – rock pile, at Reeves-McDonald mine
9. ? Visited Pend Oreille, Grandview, Sierra Zinc, Deep Creek
10. ? Visited Pend Oreille, Grandview, Sierra Zinc, Deep Creek
11. Sampled tails, at Anderson Calhoun
12. Sampled, at Black Sand Beach

4/30/2010

13. Quenched slag, at Northport
14. Pot rim slag, at Northport
15. 300' from shore @ river edge, at Northport
16. Excavation in rim down to 6"-12" removing rox from surface, at Northport

Figure 2: Photograph of Northport sampling taken by Brown

17. At north end of sand bar, at Northport
18. Crest @ west – coarse old tails, at Van Stone
19. Mine rock (dolomite?), at Van Stone
20. Ore @ crusher, at Van Stone

Methods

No details about sampling techniques are given. Beginning on page 46 of Attachment C-1, Mr. Brown describes the field trip. The notes contain information such as, "Hand sample taken @ sediment on bank." No sample IDs or GPS coordinates are given in the field notes.

May 24, 2010

A field report for this trip is provided in Attachment D to this memo.

Personnel

"Greg Diefenbach, consulting Geologist, completed all collection, handling, storage, and shipping of samples."

Greg Diefenbach
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Locations

"Samples were collected within the Upper Columbia River watershed in Washington State, between river mile 673 and river mile 719. Samples were collected at low-gradient depositional areas at Gifford Ferry, Colville Flats day-use area, Evans campground, Bossburg millsite and North Gorge campground. All sample sites map in the lake but are exposed at low water."

Methods

"2 samples were collected at 3 sites at 4 locations, for a total of 36 samples. Samples at each site included 1 surface sample and 1 sub-surface sample. Surface samples were collected from 0-5 cm depth and often included an organic rich layer. Sub-surface samples were collected directly beneath the surface samples at depths of 10-15 cm by excavating to 20 cm with a small shovel and collecting sediments from the sides of the excavation. "

Sediment sampling in the Columbia River from Trail to Waneta in Canada

September-November 2009

A field report for this trip is provided on page 6 of Attachment B to this memo.

"Conducted over two separate trips from September through November of 2009, the objective of the study was to observe flow regimes and depositional environments between Trail and the US border. A sample of coarse-grained, slag-enriched sediment from Fort Shepherd (river mile 748) was collected."

No further information about personnel or sampling is available from the field report.

Sediment sampling in the Pend Orielle River in Canada

March 9-11, 2010

A field report for this trip is provided on pages 6-9 of Attachment B to this memo.

Personnel

"Greg Diefenbach and Mike Brewer, consulting Geologists, were contracted to run the program, including site selection, sampling and sample handling, and chain of custody documentation. Shawn Kinz and Steve Saugen, co-owners of Gravity Environmental were hired to perform the coring on their company boat, *RS Palouse*."

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Mike Brewer
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Locations

"Cores were collected in Seven Mile upstream of ReMac, below ReMac, up the Salmo and at its mouth. Cores were collected in Waneta upstream of, downstream of, and at a placer mining site."

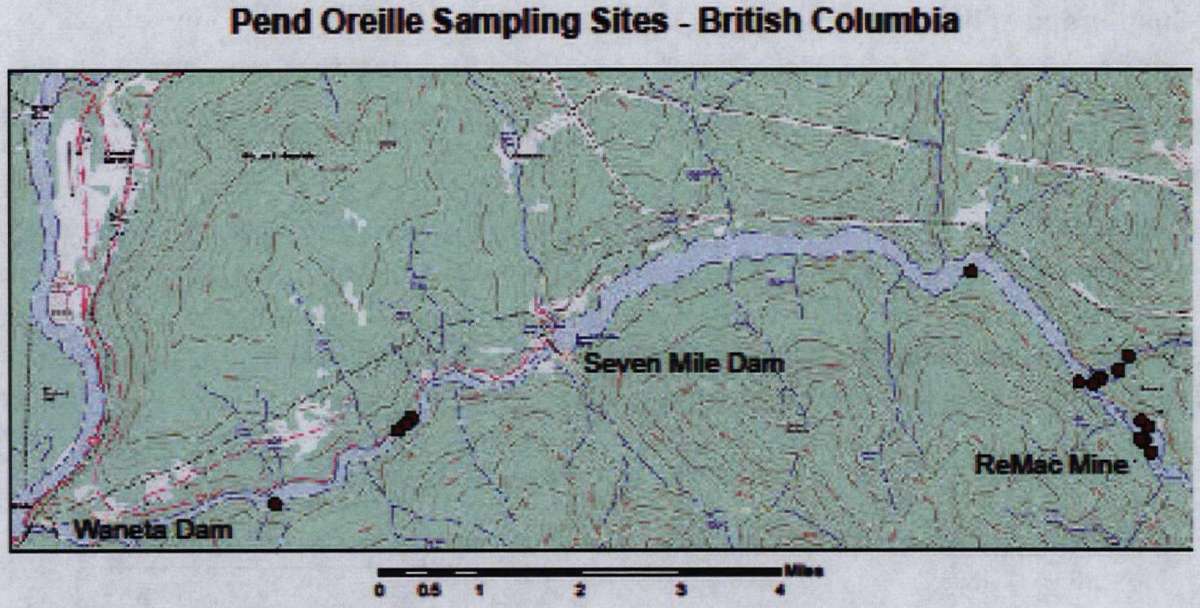

Figure 3: Map of sample locations from Diefenbach field report

Methods

"Hand sampling was conducted in the area of the historic Reeves-MacDonald mines above Seven Mile reservoir. Samples included waste rock, coarse rejects, and oxidized regolith soil."

"Sediment Cores were collected by Vibracore drilling in five foot long, four inch outside diameter, clear Lexan tubing. Target sediment depth was 1m and actual core depths ranged between 11cm and 1.4m. Cores were extruded into a PVC trough and sampled at 5 or 10 cm intervals. Cores less than 20 cm were composited."

Suspended sediment sampling in the US

May 21 – 28, 2010

A field report for this trip is provided on pages 12-14 of Attachment B to this memo.

Personnel

"Greg Diefenbach, consulting Geologist, was contracted to run the program, including site selection, sample handling, storage, chain of custody, and shipping. Mike Duffield and Mark Weber of Gravity Environmental provided sampling equipment and operational support, including the use of the boat RS Wallawa. Eric Weatherman of Columbia Navigation provided the boat Mon-Ark for the Pend Oreille sampling. Smaller tributaries were accessed at stream banks reached by truck."

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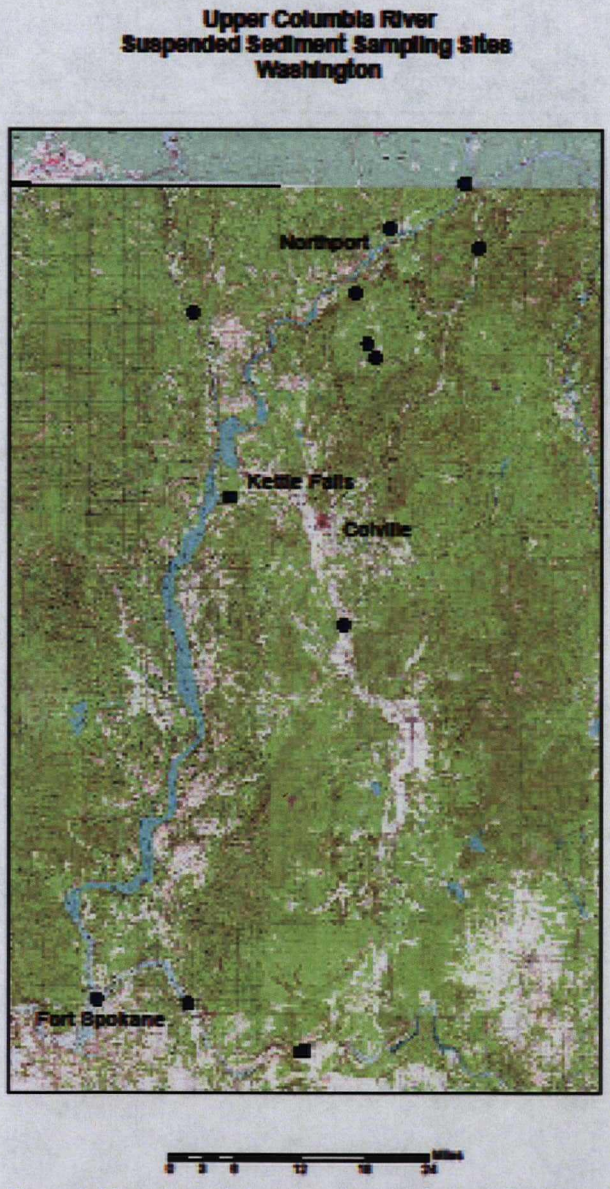

Figure 4: Map of sample locations from Diefenbach field report

Locations

"Samples were collected on select tributaries of the Columbia River...The Pend Oreille, Colville, and Kettle, and Spokane Rivers, and Onion, Deep, and Big Sheep Creeks, entering Lake Roosevelt or the Columbia River between USGS topographic series river miles 746 and 639, were sampled at one or more locations and one or more depths, depending on channel depth and accessibility."

Methods

"Suspended sediments were collected from 100 L of site water... drawn by peristaltic pump and passed through an in-line LISST particle size analyzer. Outflow was directed through a vortex separator attached to the pump apparatus followed by a 0.45 micron cellulose acetate filter (142 mm diameter). Water was pumped at 1 L/min for 100 minutes at each site."

Samples

The following is a description of the samples taken:

> *"A" samples were collected in 8 oz wide mouth plastic jars from the vortex separator and from the filter housing. This "coarse" fraction was collected with a large amount of water relative to sediment mass, requiring transfer to 8 or 16 oz narrow mouth Nalgene bottles for shipping and storage.*
>
> *"B" samples consisted of the filters from the filter housing. Filters were considered clogged when the pressure at the pump reached 15 PSI, the maximum pressure the system can maintain before hoses disconnect. This "fine" fraction was collected on folded filters in 8 oz wide mouth jars.*
>
> *"C" and "D" samples consisted of post process water collected from the out-flow of the filter housing. These samples were collected in 1 L glass bottles on the first day. Sixteen (16) oz Nalgene bottles arrived for use the second day of sampling, and the previous day's samples were transferred from glass bottles into plastic. Eight (8) oz Nalgene bottle arrived for use on the fourth day.*
>
> *"E" samples of unfiltered site water were collected over the last 3 days.*

Soil sampling from landslide faces in the US

September 2010

Greg Diefenbach drafted the memo in Attachment E describing the landslide sampling field activities, but provides no details about who personally attended the sampling. Mr. Diefenbach provides no sampling methods or coordinate details beyond simple location descriptions.

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Description from field report: "Samples of in situ material from landslide faces in the upper Columbia basin were collected in support of an investigation of landslide impacts on river/lake hydrology by Exponent Consulting... Sampling was successful at three sites, two above Kettle Falls and one below."

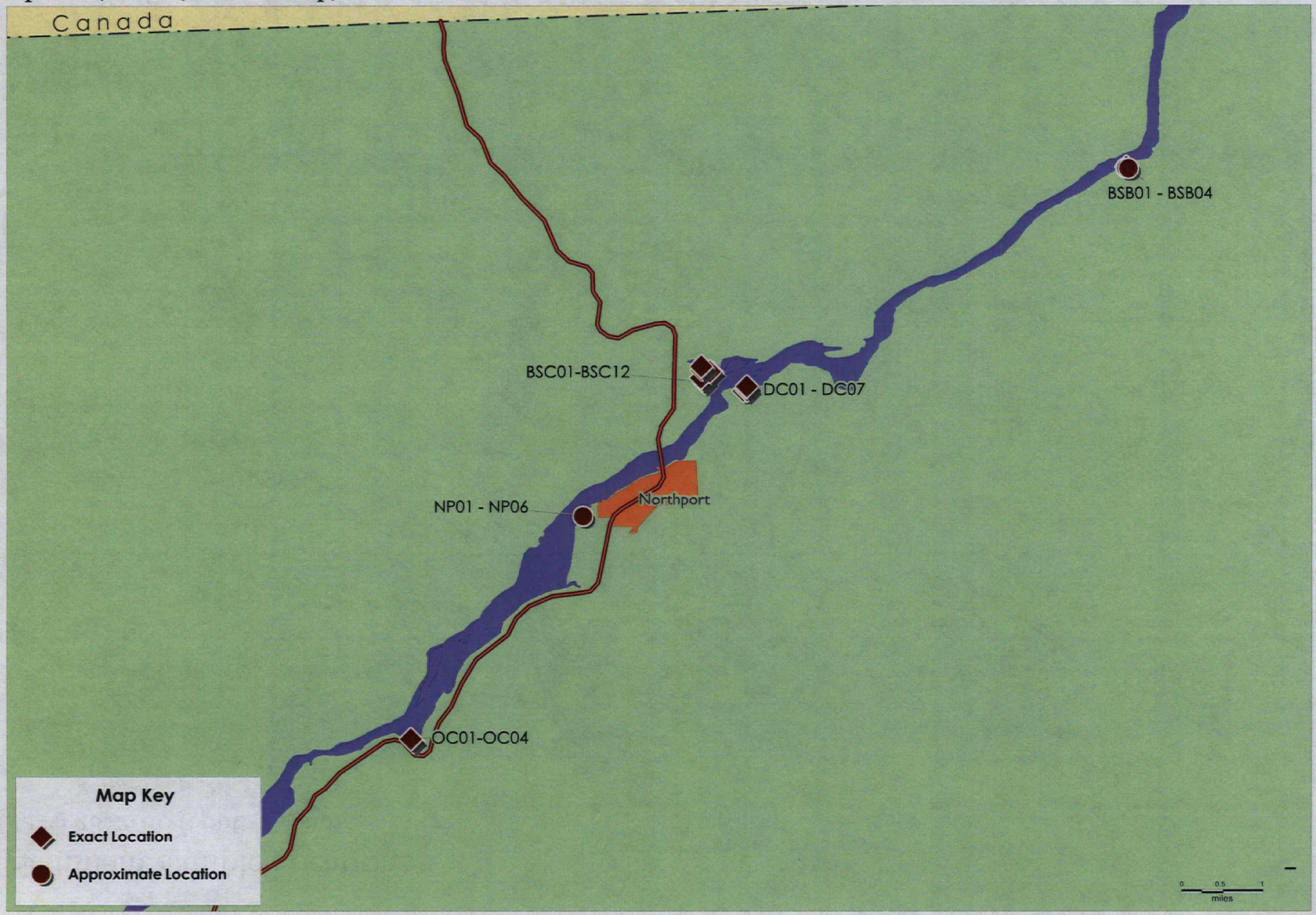
1. Kamloops Island: "The slide face sampled measured 25 feet in length, triangular, with a peak height of 15 feet. Material is a consistent, massive, fine grained, light grey to beige, chalky clay."

2. St. Paul's Mission: "The St Paul's Mission site is located above the historic Kettle Falls, southwest of the state historical site, and between the highway 395 Bridge and transmission lines, LB Columbia river mile 703.3. The westward facing slide is underlain on the northern end by an outcrop of quartzite and schist dipping southeast at 15°. The southern end underlayment is below lake level, but presumably the same. The slide face is concave, 500 feet in length, peak height of 30 feet, and an average slope of 50°... Two samples were collected: a southern sample of dryer, looser, pebbly sand, and a northern sample of clumped, pebbly sand."

3. Saints Flats: "The Saints Flat slide is located two miles south of Mission Point, LB Columbia River mile 678, roughly half way between Daisy and Gifford." No further description of sample location, although Figure 6 (a photograph) is captioned "Saints Flat slide collection point."

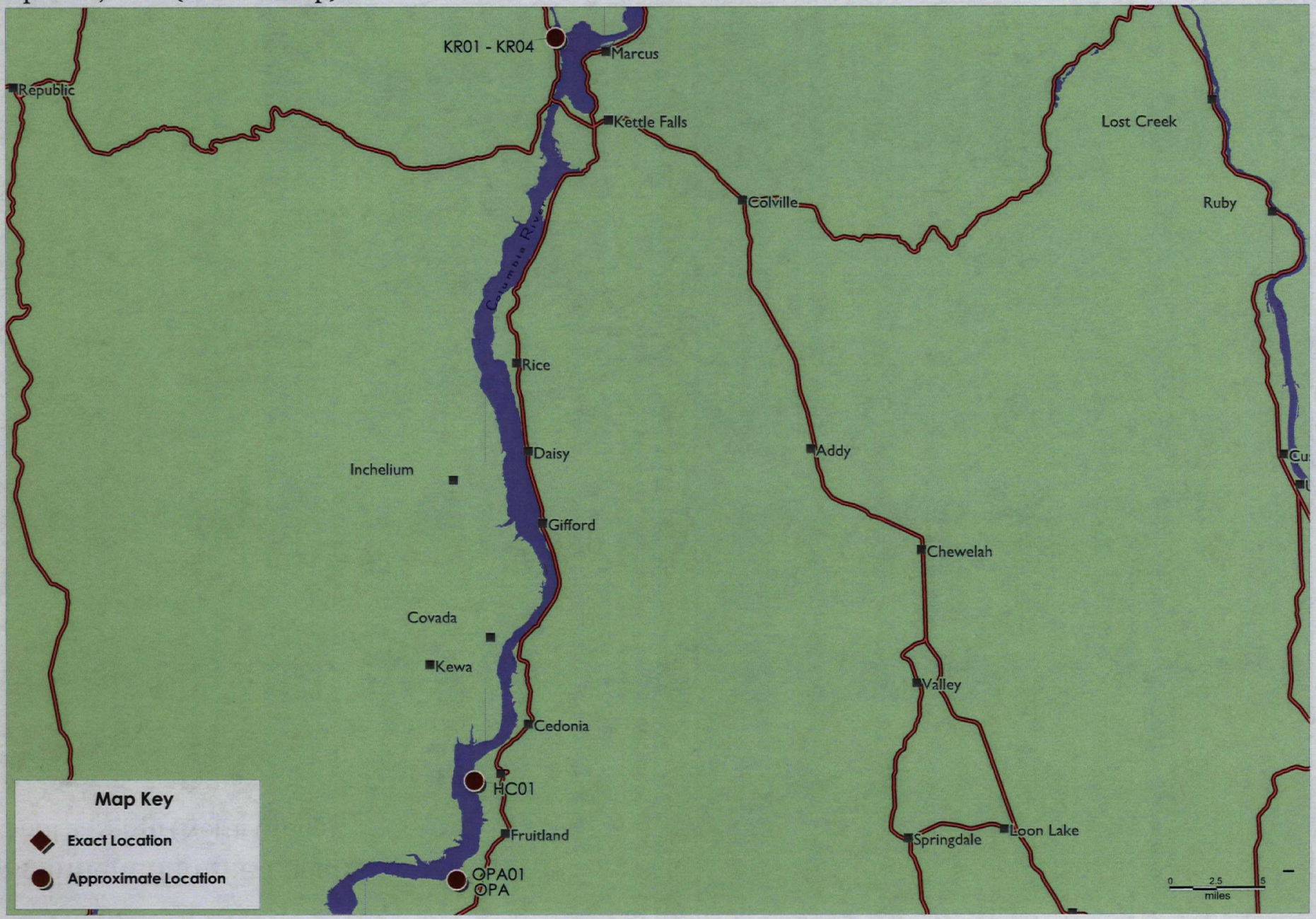
Sediment Sample Locations

April 28, 2010 (North Group)



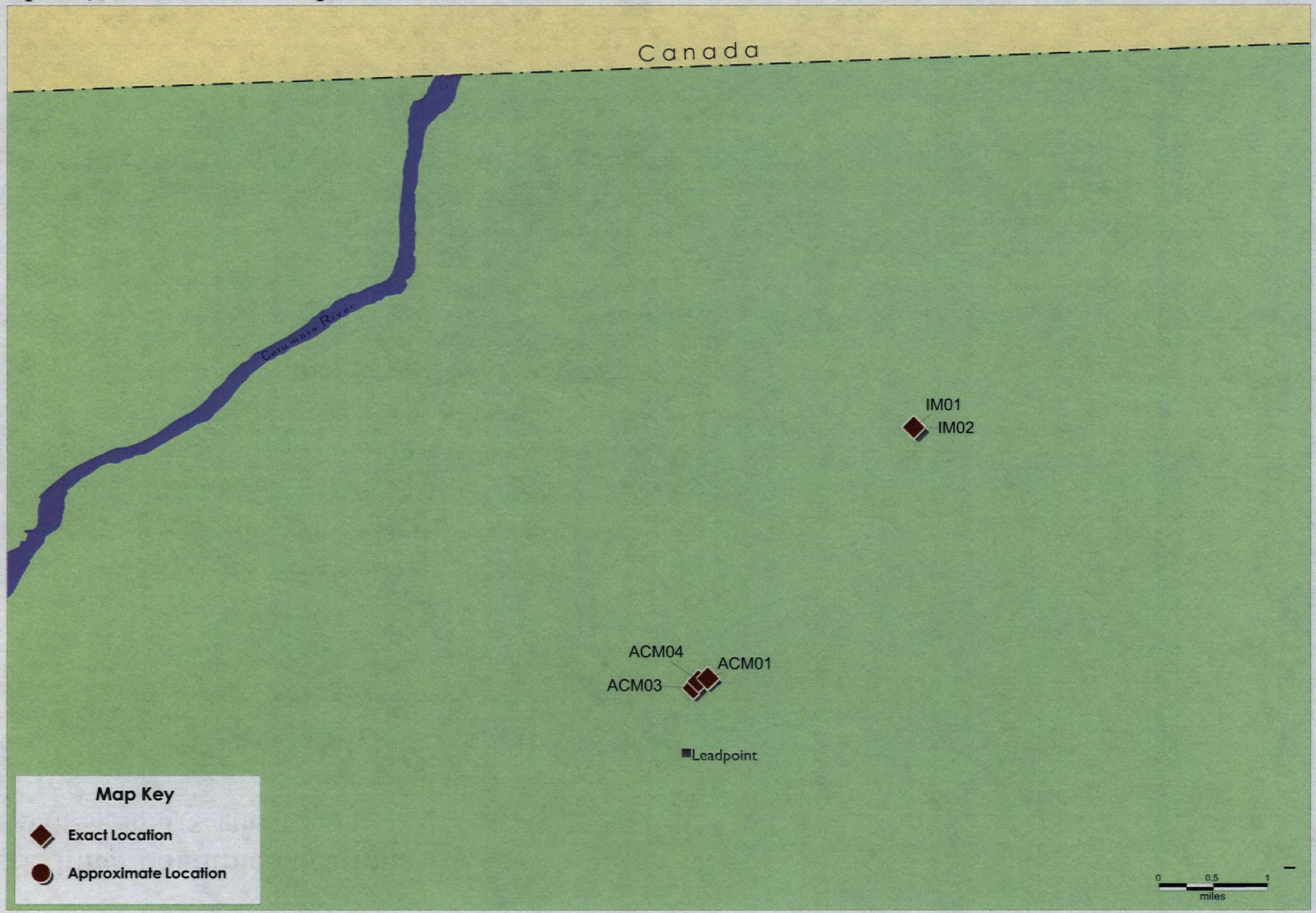
Sediment Sample Locations

April 28, 2010 (South Group)



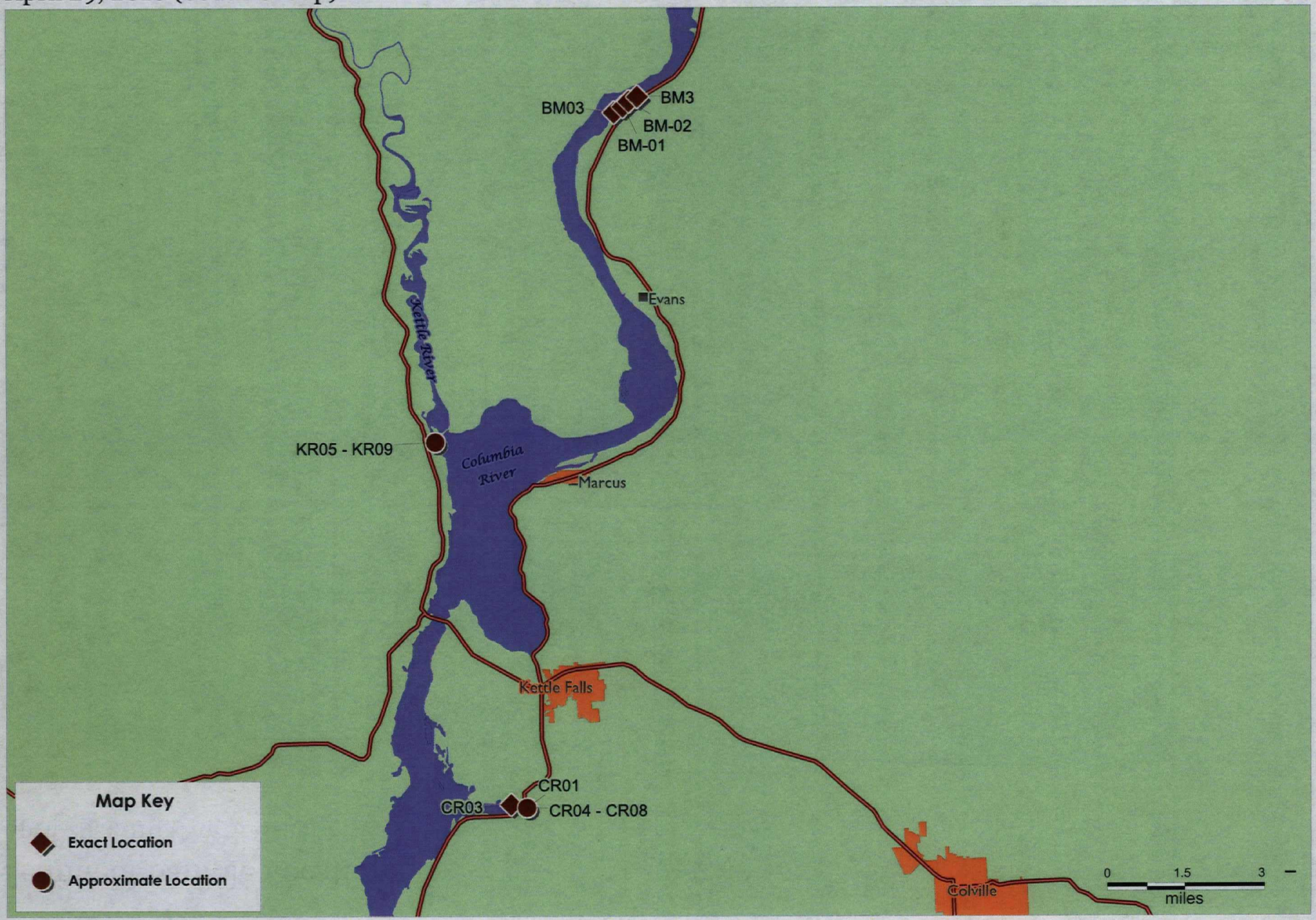
Sediment Sample Locations

April 29, 2010 (North Group)



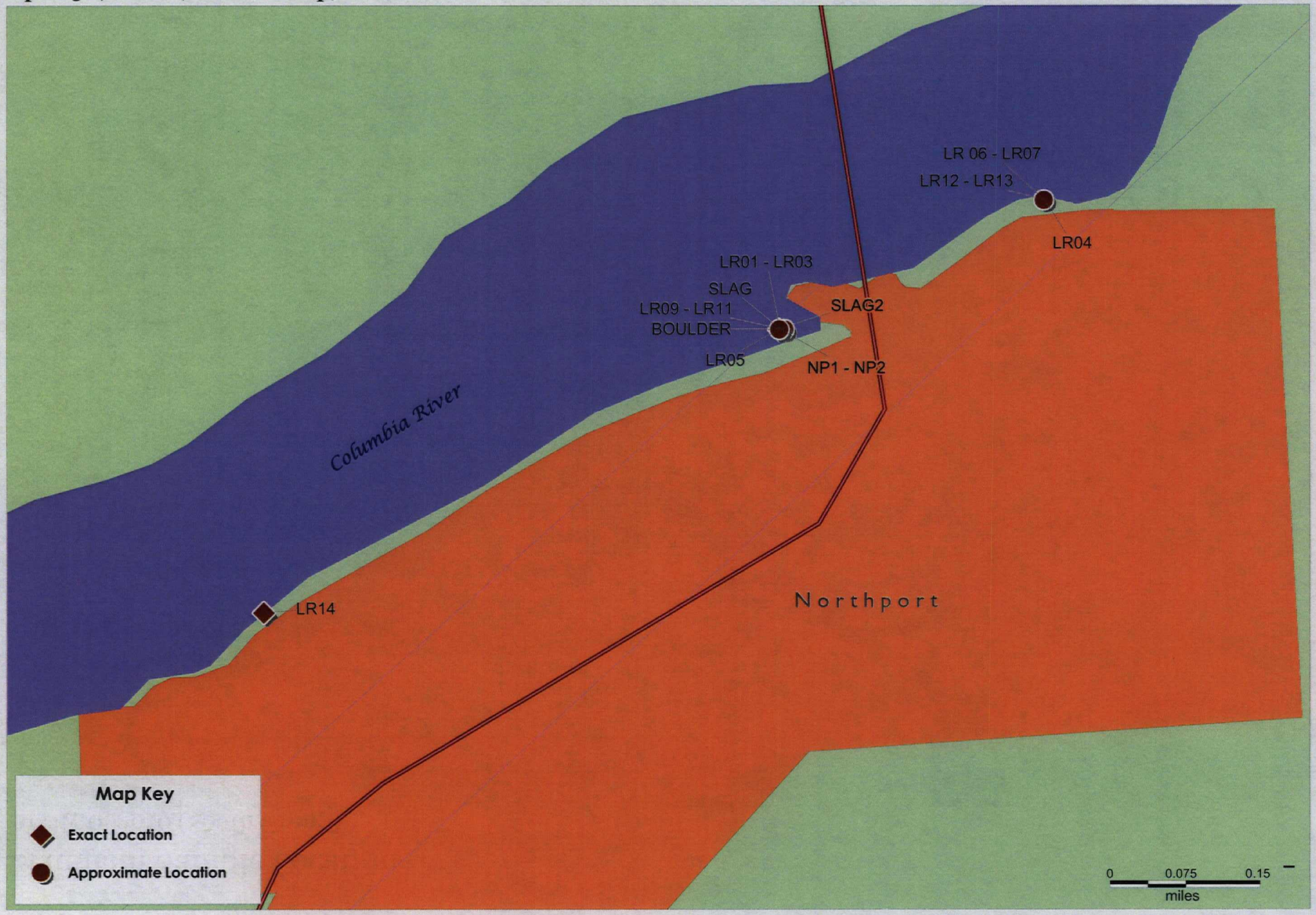
Sediment Sample Locations

April 29, 2010 (South Group)



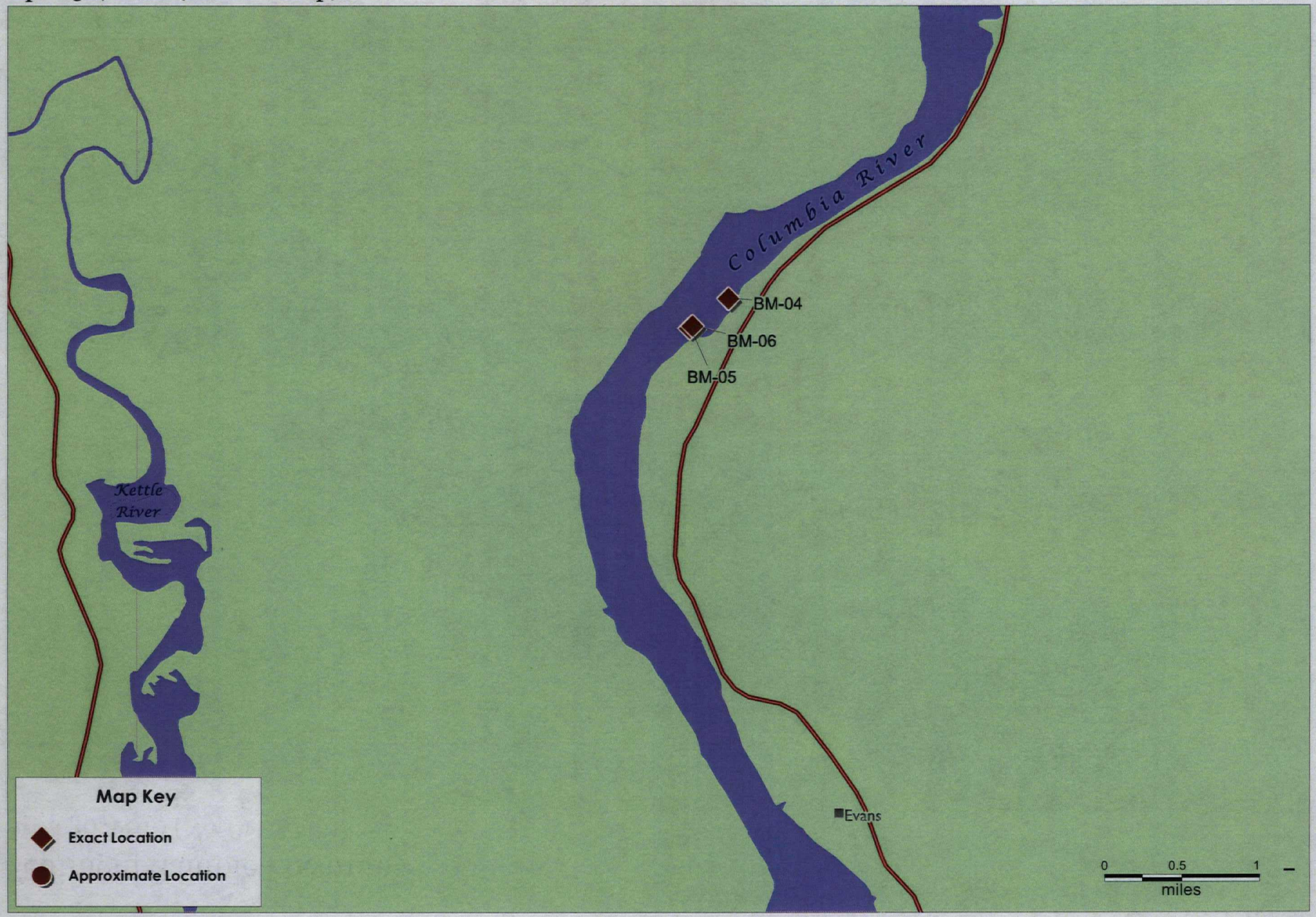
Sediment Sample Locations

April 30, 2010 (North Group)



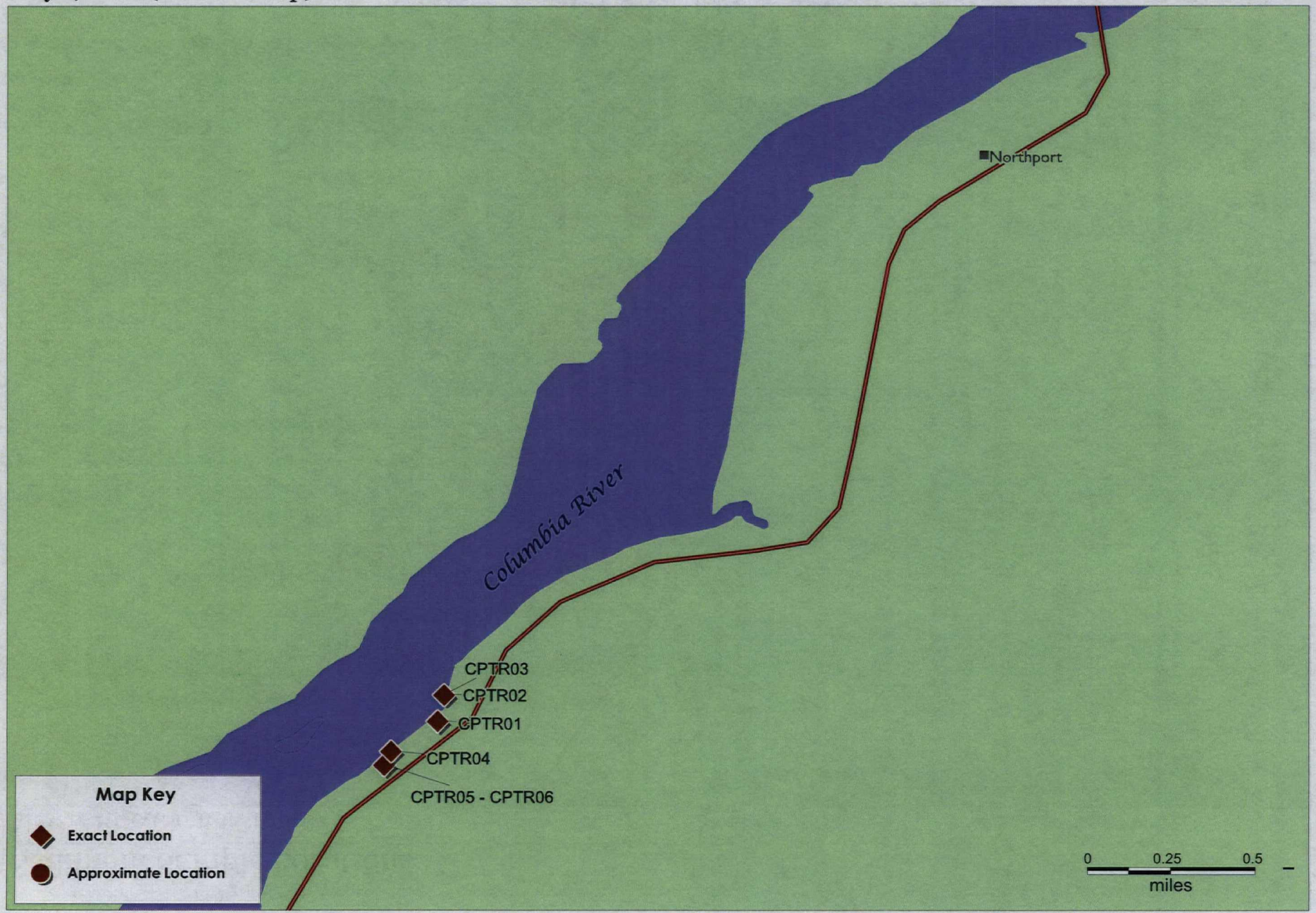
Sediment Sample Locations

April 30, 2010 (South Group)



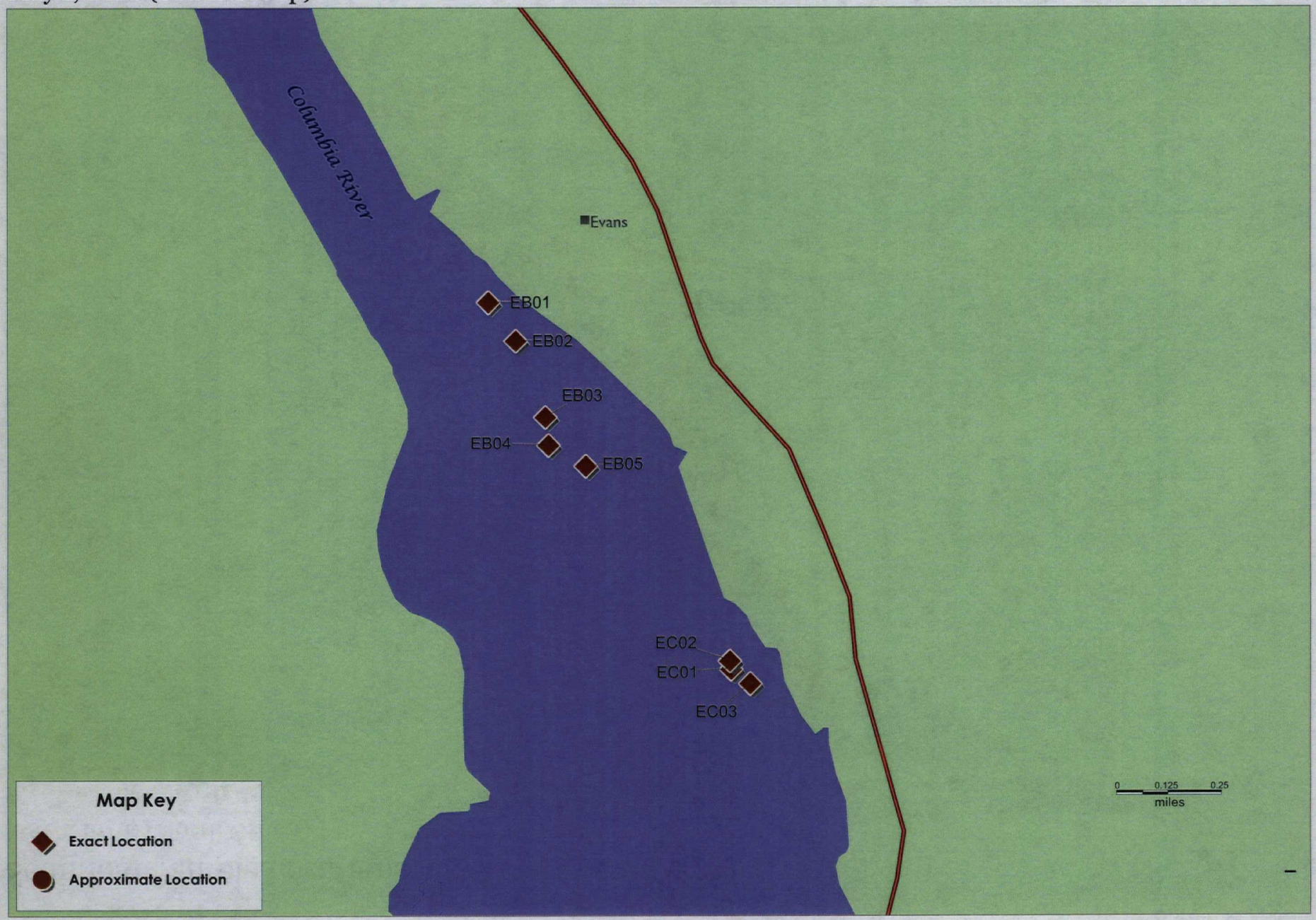
Sediment Sample Locations

May 1, 2010 (North Group)



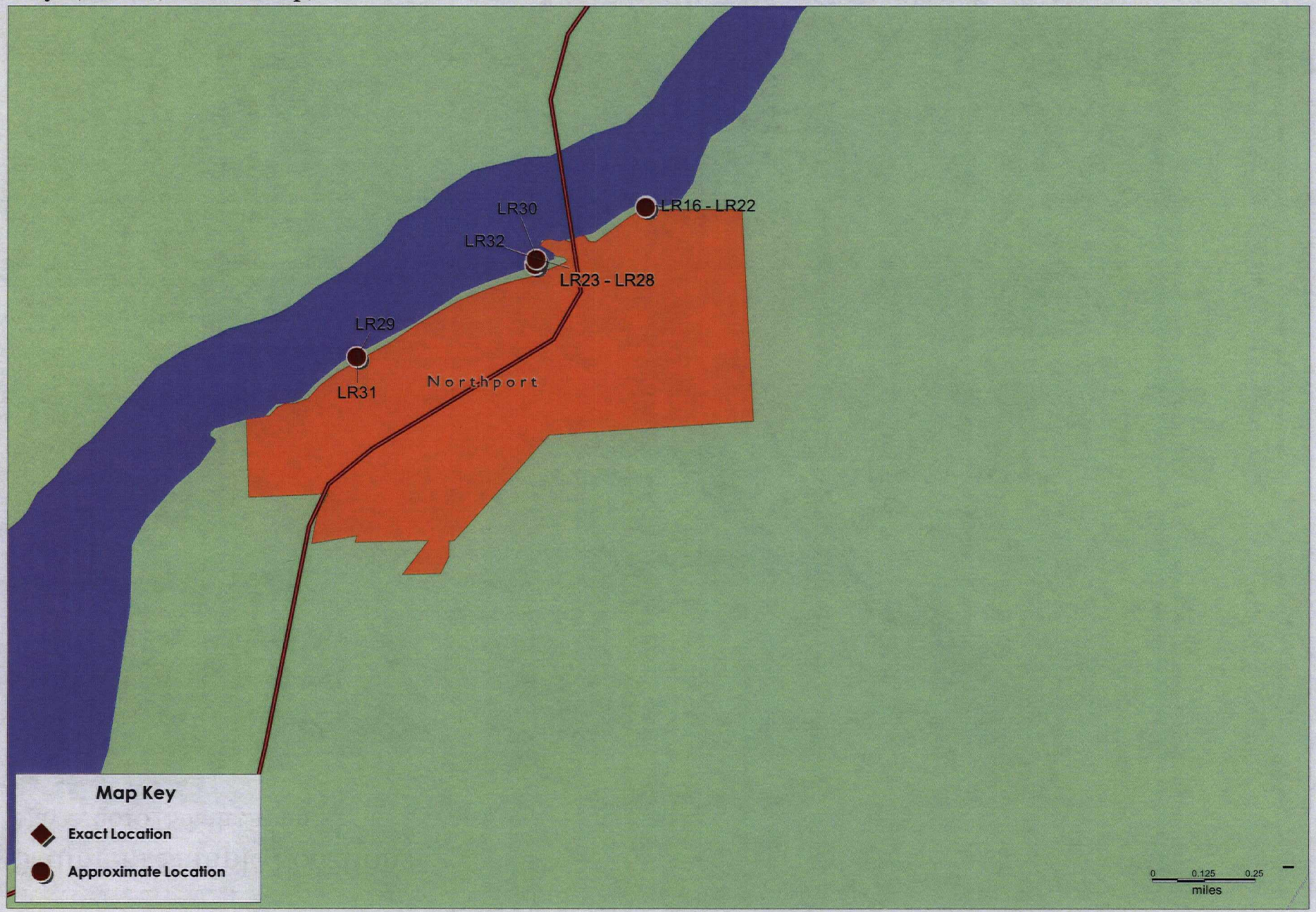
Sediment Sample Locations

May 1, 2010 (South Group)



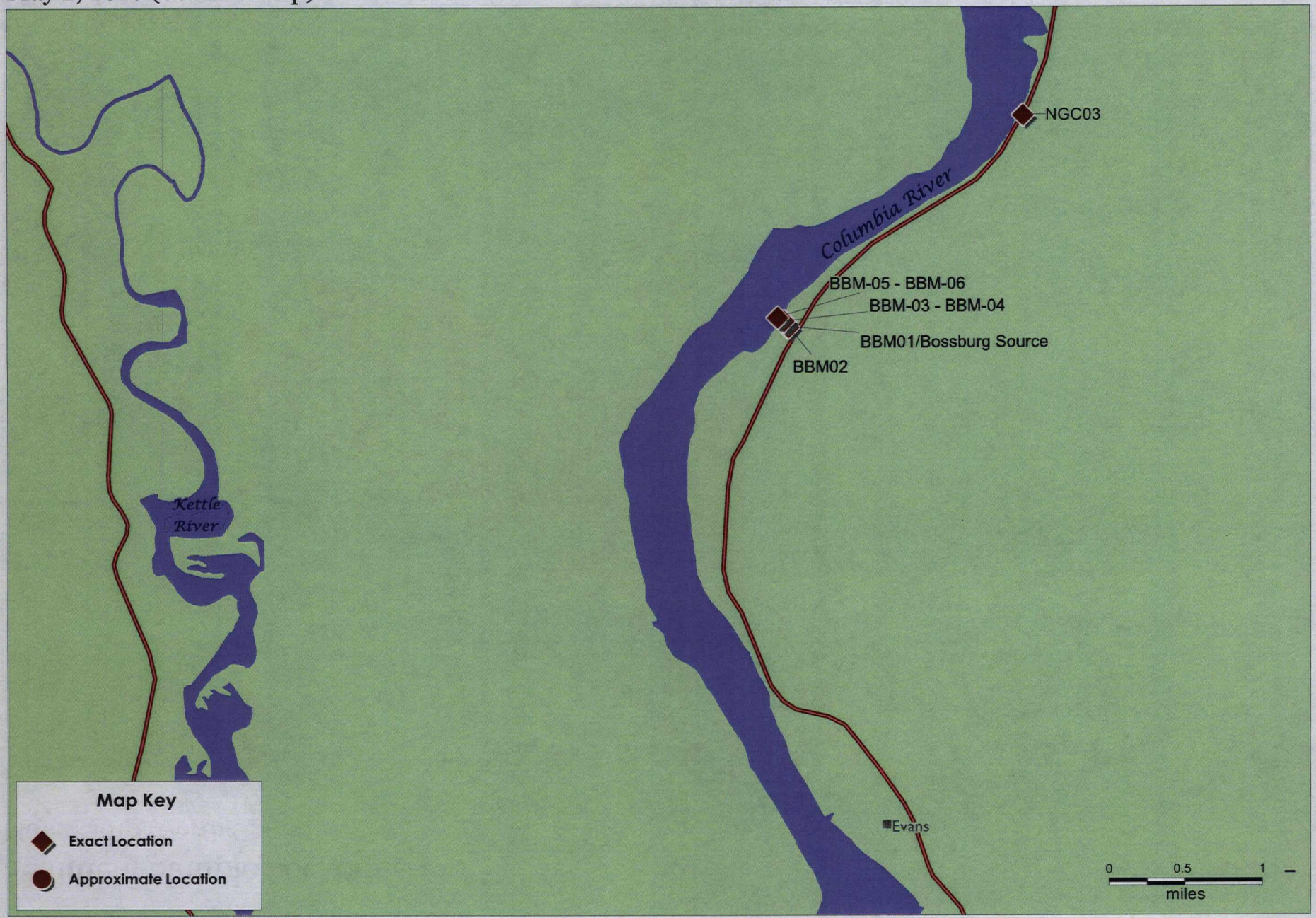
Sediment Sample Locations

May 2, 2010 (North Group)



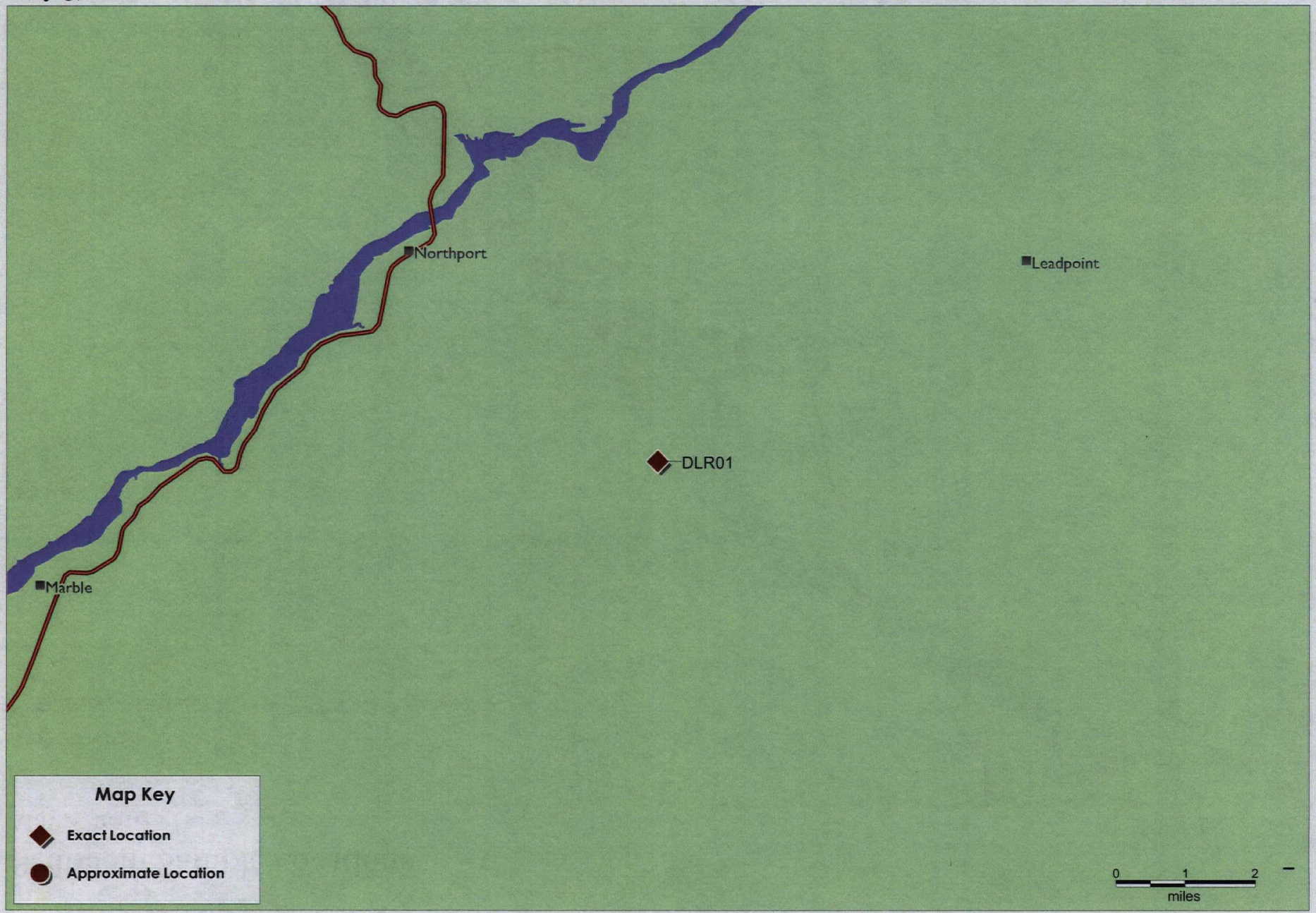
Sediment Sample Locations

May 2, 2010 (South Group)



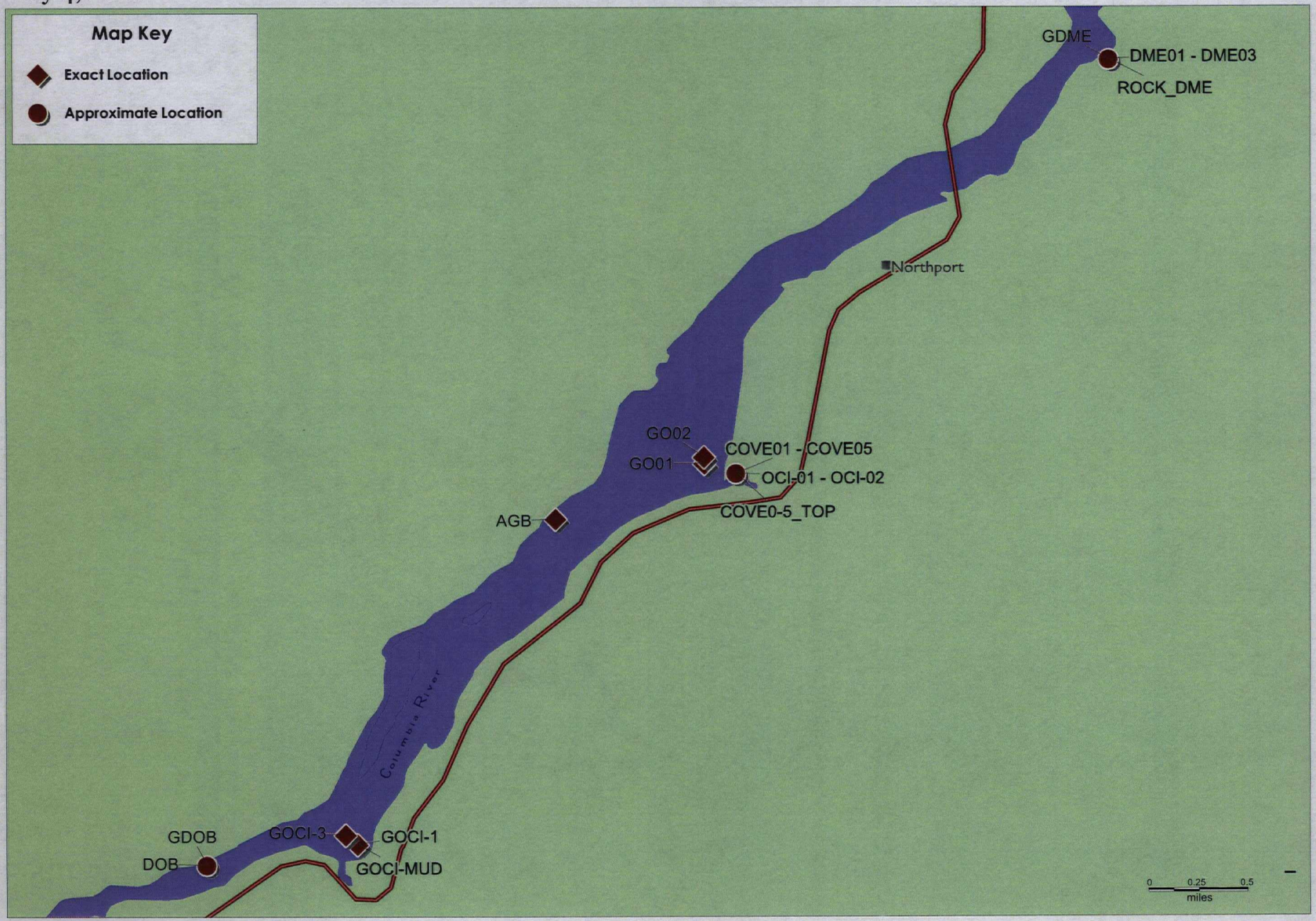
Sediment Sample Locations

May 3, 2010



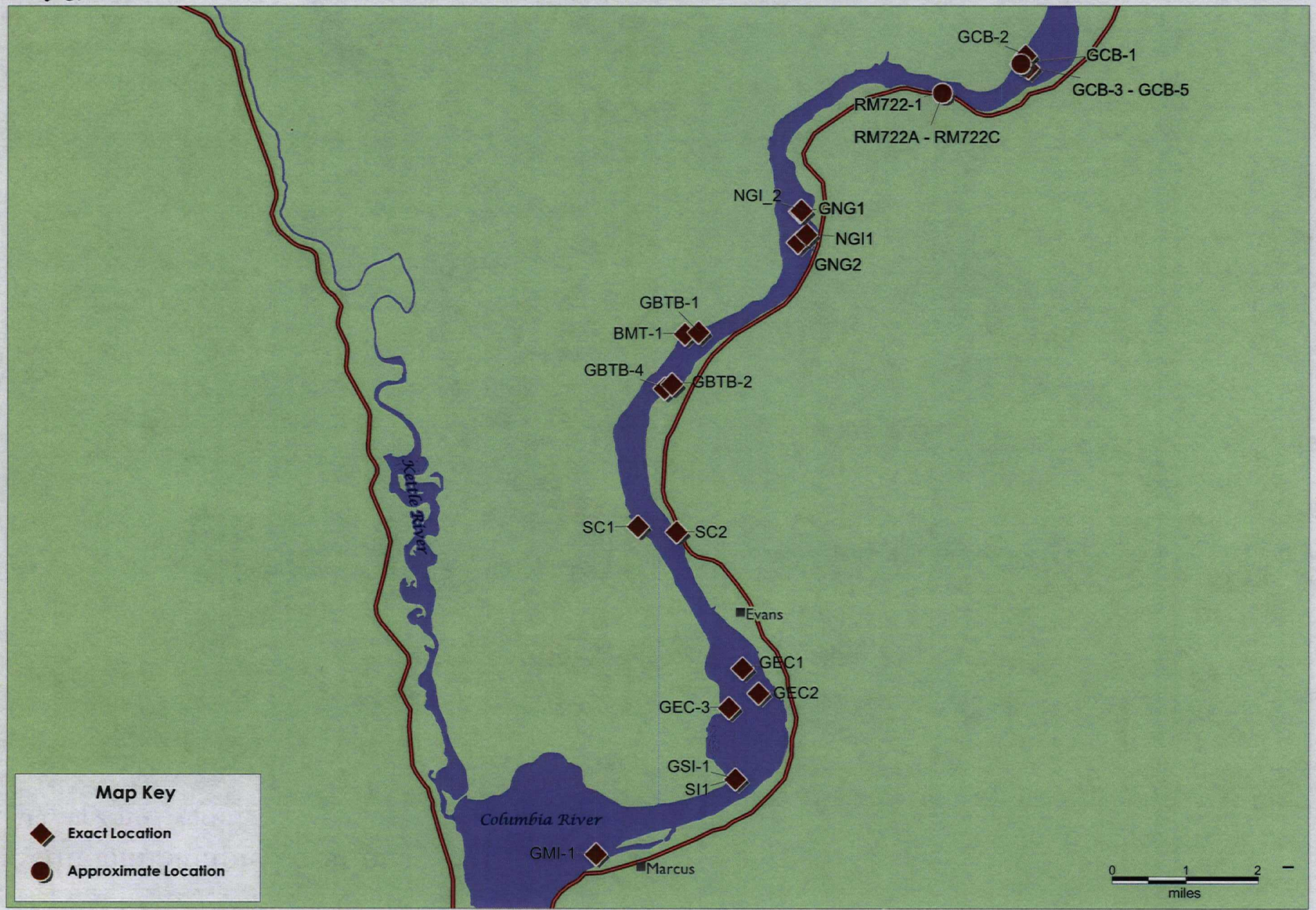
Sediment Sample Locations

May 4, 2010



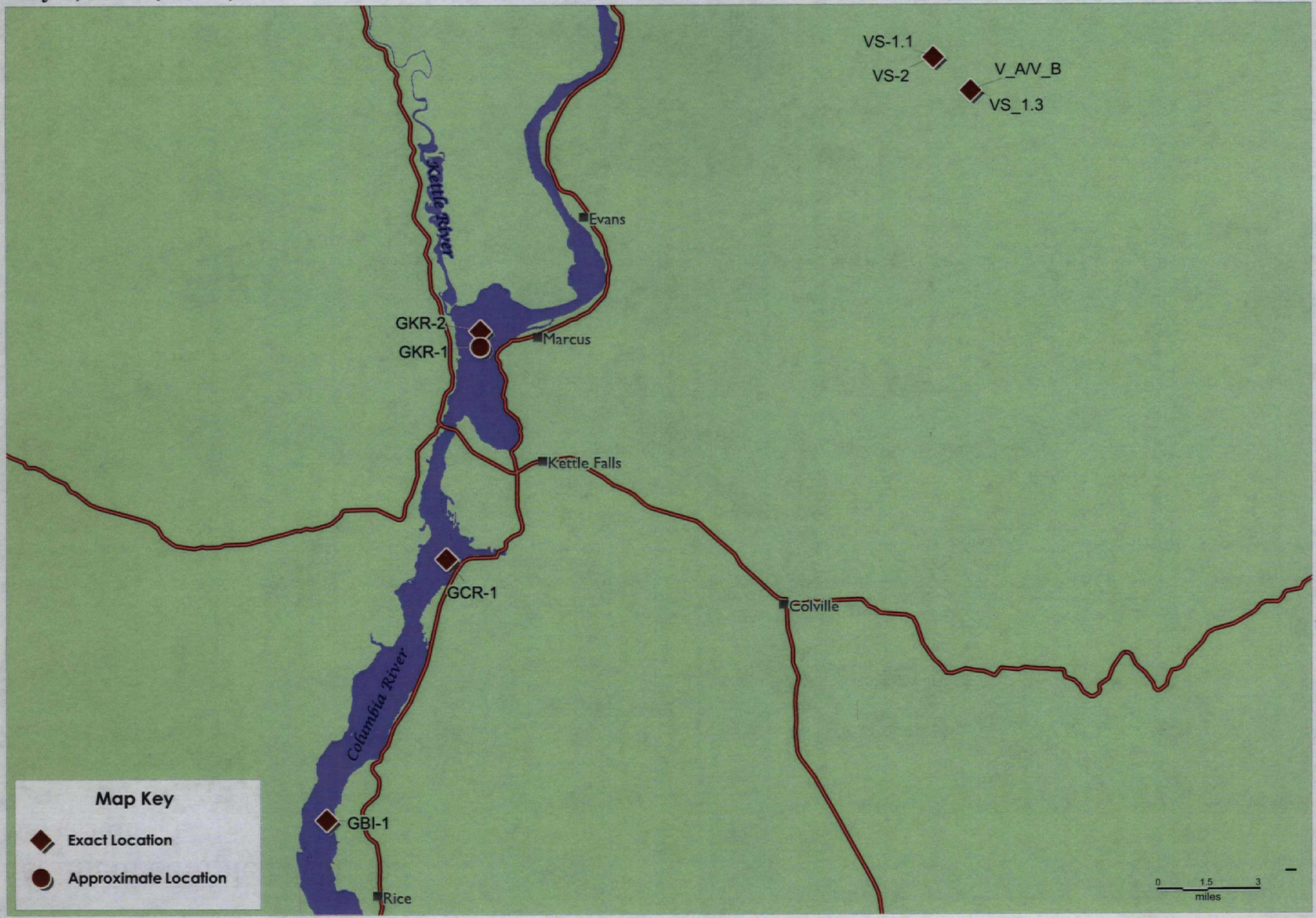
Sediment Sample Locations

May 5, 2010



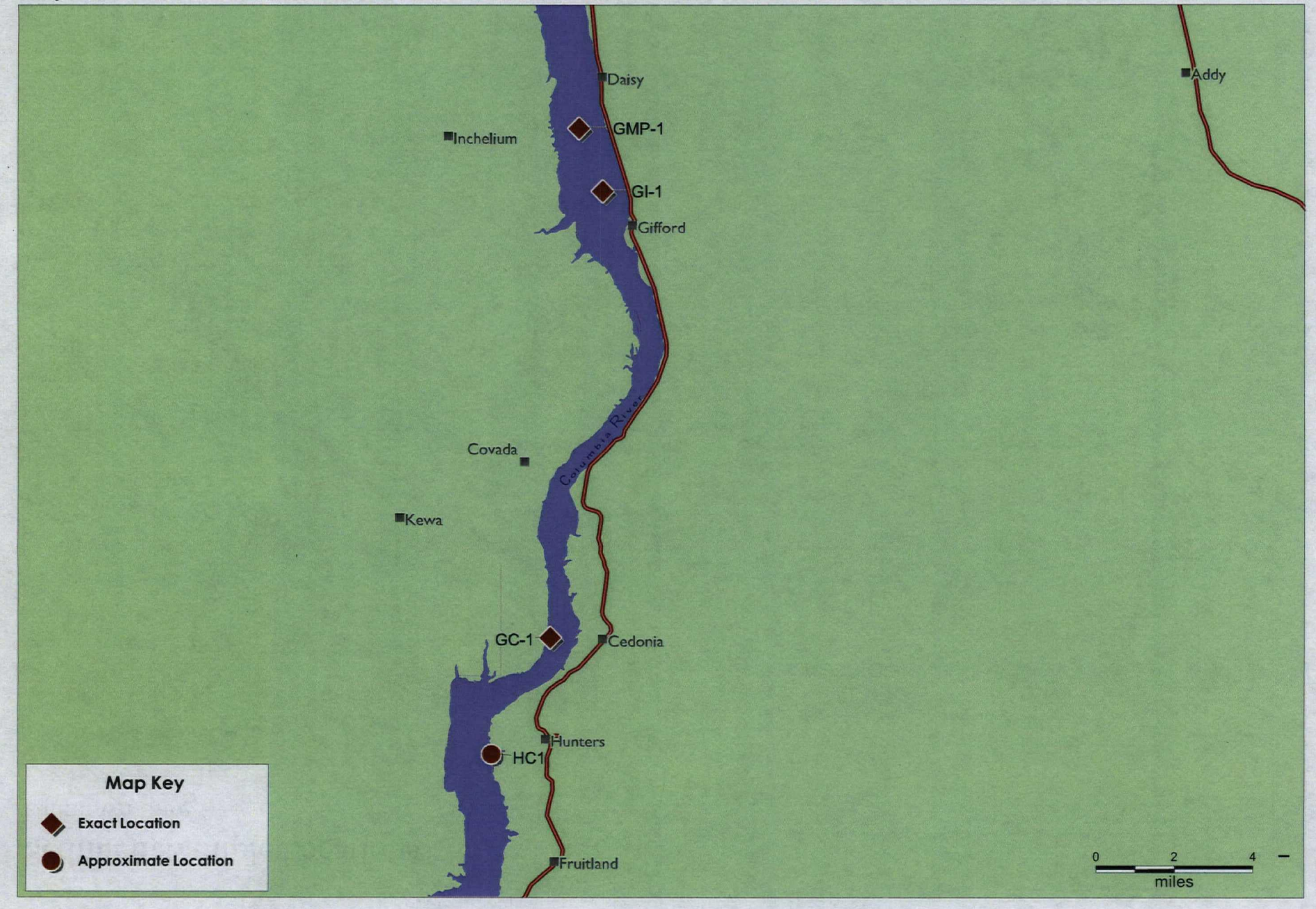
Sediment Sample Locations

May 6, 2010 (North)



Sediment Sample Locations

May 6, 2010 (South)



Sediment Sample Locations

Unknown Date